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Original Article

Employment in Academia: To What Extent Are Recent Doctoral Graduates of Various Fields of Study Obtaining Permanent Versus Temporary Academic Jobs in Canada?

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While most doctoral students aspire to become a full-time professor, many graduates with doctoral degrees may instead be employed in temporary positions as university teachers or researchers. The purpose of this paper is to assess the extent to which these early employment experiences differ for doctoral graduates of various fields of study, using Canada as a case study. Drawing on Statistics Canada's 2013 National Graduates Survey, our results reveal that doctoral graduates of most fields, especially those with degrees in the sciences, arts, and humanities, are more likely to be in temporary forms of academic employment than they are as full-time professors, 3-to-4 years after graduation. The findings highlight the labor market realities facing doctoral graduates in the Canadian academic labor market. They should also be very informative to researchers and policy analysts in other countries where doctoral graduates experience similar challenges navigating academic job markets.
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Introduction

A doctoral degree represents a substantial investment in human capital. Doctoral graduates typically spend at least 10 years in university and make several economic sacrifices along the way including lost wages, foregone job seniority, and delayed pension contributions and other retirement savings. Many students who pursue a PhD may also delay important life course events, such as cohabitation, starting a family, or purchasing a home (see Maldonado *et al.*, 2013).[1] In return, PhD

graduates typically fare quite well in the Canadian labor market. They experience higher earnings, lower rates of unemployment, and have a higher labor force participation rate than their counterparts with master's and bachelor's degrees (see Edge and Munro, 2015). However, despite several decades of postsecondary (education beyond high school) expansion (see Edge and Munro, 2015; Schofer and Meyer, 2005), the academic labor market for doctoral graduates may not be as strong as it once was. There is widespread speculation within the academic community that a significant number of graduates with earned doctorates end up working in temporary jobs within the academic profession such as temporary (sessional) instructors or research assistants (MacDonald, 2013; Muzzin, 2013; see also Rajagopal, 2002; Field and Jones, 2016 for a review).

Recent policy research in Canada also suggests that the employment outcomes of doctoral graduates may not be consistent with their aspirations (Edge and Munro, 2015), and a growing body of international research points to increasing numbers of doctoral students taking up non-academic employment in many OECD countries (see Boulos, 2016; Conti and Visentin, 2015; Neumann and Tan, 2011). However, there is little population-based research available to assess the extent to which this is occurring in Canada, and none of the studies we identified reveals which factors (e.g., field of study) may help doctoral graduates successfully transition through the academic profession.

The key purpose of this study is to provide a Canadian perspective to the international literature on this topic by examining the employment outcomes of doctoral graduates of various fields of study, while identifying the extent to which those who are employed in academic jobs are employed in temporary (sessional) versus permanent full-time faculty or research positions. This research should be useful to graduate program coordinators responsible for providing their students with education and training that accommodates the workforce realities facing doctoral graduates transitioning to the labor market. It will also contribute to the growing body of the international literature on the employment outcomes of doctoral graduates and will be of particular interest to future students, researchers, analysts and policy makers in countries where academic job markets are oversaturated with PhD graduates, including the USA, Australia, as well as several countries across Europe, among others (see, for example, Afonso, 2016; Boulos, 2016; Paolo and Mañé, 2016; Jackson and Michaelson, 2015; Conti and Visentin, 2015; Pedersen, 2014; Neumann and Tan, 2011; Huisman *et al.*, 2002).

Review of the Literature

In recent decades, the expansion of postsecondary education in Canada has extended beyond college and undergraduate programs to graduate level programs. Numerous graduate degree programs have emerged, and many older, established

programs have expanded their intake rapidly. Primarily undergraduate universities in Canada have launched new programs at the master's level, and institutions with master's degree programs have also looked upward to establish doctoral programs. In fact, during the first decade of this century, the number of students enrolled in doctoral programs increased by nearly 73% (see Edge and Munro, 2015, 9). Despite this growth, Canada remains behind other developed countries in terms of producing graduates with doctoral degrees (see Conference Board of Canada, 2019; Desjardins and King, 2011).

The expansion of doctoral programs is partly due to increasing government pressure to expand postsecondary education to be competitive in a global environment (Clark *et al.*, 2009). Both federal and provincial funding to doctoral programs have been driven by the anticipated retirement of older faculty members, along with the need for more faculty to service the expansion of graduate and undergraduate programs across the country (see Maldonado *et al.*, 2013).[2] Recent research also suggests that the majority of graduate students who pursue a PhD do so to become a university professor[3] (see Etmanski *et al.*, 2017; Edge and Munro, 2015; Maldonado *et al.*, 2013; Desjardins, 2012). This is understandable, as full-time professors enjoy a decent salary, good job security, flexible hours, high levels of job autonomy and authority, extensive pension plans, and significant medical coverage.

As university enrolments continue to rise, it is widely believed that the higher education system should require more faculty to educate them. However, there is concern that universities are not hiring full-time professors at the same rate that they are churning out graduates with PhDs (see Edge and Munro, 2015). In fact, a recent study funded by the Higher Education Quality Council of Ontario (HEQCO) found that only one in five PhD graduates in Ontario was successful in securing full-time employment as a university professor (Maldonado *et al.*, 2013). Drawing on a nationwide analysis, another study funded by the Conference Board of Canada reached similar conclusions (Edge and Munro, 2015).

Yet, if the expanding postsecondary system is expected to require more academics, but the majority of doctoral graduates are not successful in securing full-time employment within the academic profession, then two key questions arise. First, where are these new doctoral graduates finding employment? And, second, how are universities servicing the needs of their programs? With respect to the latter question, another study commissioned by HEQCO suggests that universities in Ontario are increasingly relying on part-time and temporary faculty to service their teaching needs (Field *et al.*, 2014). Likewise, a separate study by Brownlee (2015) found that between 2002 and 2008, the number of contract faculty in the province of Ontario grew by 59%, whereas the number of permanent tenure-stream faculty grew by 25%.

Rather than replace retiring faculty with permanent full-time academics, it is more cost-effective for universities to hire sessional (temporary/part-time)

instructors, a common form of employment within the academic profession. Sessional instructors teach university courses, but they work under short-term contracts. They receive far less pay; have fewer employment benefits, and much less job security in comparison with full-time university professors (MacDonald, 2013).

Sessional teaching may be an attractive option for retired professors who would like to remain active teachers. It may also represent a valuable opportunity for postdoctoral fellows, or doctoral students near the end of their programs, to bolster their CV by gaining some teaching experience before they enter the job market to become a full-time professor. Contract teaching could also be beneficial for professionals who have full-time careers and are looking for opportunities to teach on the side.

However, sessional teaching is not desirable as a primary job or a career. Yet, either out of perseverance to secure a tenure-track position, or being unable to find an adequate job outside of academia, there is widespread speculation within academic circles that many doctoral graduates end up spending several years, and sometimes entire careers, in sessional work (Field and Jones, 2016; MacDonald, 2013; Muzzin, 2013; Rajagopal, 2002). In addition to sessional teaching, doctoral graduates may also find themselves trapped in part-time or temporary research-related positions, or spend years navigating a perpetual string of postdoctoral fellowships in hopes of securing a permanent academic position. These jobs do not offer the same level of compensation, job security, or prestige as permanent academic positions, and consequently, doctoral graduates who continuously work in contingent sectors of academia can develop very cynical views of the doctoral program and of the academic labor market (see Acker and Haque, 2017).

It is important to consider field of study when examining the transitions of doctoral degree holders, as graduates of technical and applied fields typically report higher earnings than their colleagues with degrees in generalist fields such as the fine arts and humanities (Desjardins, 2012; Desjardins and King, 2011; Walters, 2004). These disparities across fields are also observable in their early labor force activities. For example, profile reports drawing on the 2007 National Graduates Survey suggest that doctoral graduates of the humanities and to a lesser extent social sciences are much less likely to secure employment and more likely to be unemployed within 2 years of graduating, compared to graduates from computer science, mathematics, physical sciences, and engineering (Desjardins and King, 2011). They are also more likely to report working part-time.[4] Specifically, about 18% of humanities doctorates and 15% of social science graduates report being employed part-time, compared to only 2% of engineering graduates and 4% of computer science, mathematics, and physical science graduates (Desjardins and King, 2011, 47). The labor market advantages experienced by graduates of technical and applied fields is attributable, in part, to their acquisition of advanced 'hard' skills, which are considered to be complex, more directly tied to

productivity, and in greater demand among high income sectors of the economy (see Walters, 2004).

Much less is known regarding the extent to which recent doctoral graduates of various fields of study are concentrated in temporary forms of employment within the academic profession. This is an important issue, as graduates of some fields may be better able to navigate non-academic labor markets than others. For example, it is well documented that graduates of business, finance, economics, as well as the so-called STEM fields, are more likely to obtain technical and applied skills that are easily recognized in the general labor market (see Walters, 2004 for a review). Thus, doctoral graduates of these fields may be less likely to stay in an oversaturated academic job market if they believe they have skills that are more transparent and rewarded outside of academia.

On the other hand, doctoral graduates of the liberal arts may be more likely to spend the better part of their programs engaging in academic endeavors such as conducting literature reviews, understanding theoretical perspectives, working as teaching and research assistants, preparing research, and presenting papers at academic conferences. These skills and the acquired knowledge may not directly equate to 'real-world' experience or be recognized by students (or employers) as relevant to employment sectors outside academia. Hence, doctoral graduates of academic (generalist) fields of study may not recognize the extent to which their extensive research, communication, information management, analytical, problem-solving, and critical thinking skills may be applied outside of the academic profession. In turn, they may be more likely than their counterparts of technical fields to depend on securing a job in academia, and, therefore, be more likely to 'stick-it-out' by spending several years as a sessional instructor or research assistant; jobs that were typically reserved for master's degree holders just a few decades earlier. Yet, little is known regarding whether doctoral graduates of some fields of study are better equipped to successfully transition through the academic profession than others, and which ones are more likely to find careers elsewhere if the academic job market is heavily saturated.

For the most part, public knowledge on this matter in Canada is based largely on media reports, which are often fueled by anecdotal evidence, and most of the literature on the career prospects of PhD graduates in Canada that we could find are in magazines and newspapers, or published in academic newsletters. Much of the existing population-based literature is concentrated in government or policy reports that are not readily available or well integrated in the peer-reviewed literature (see Desjardins and King, 2011; Edge and Munro, 2015; Jonker, 2016; Maldonado *et al.*, 2013), and these reports are based on descriptive statistics and cross-tabulations which do not control for other important factors that impact employment outcomes of doctoral graduates.

The limited peer-reviewed articles that we found on this issue are dated (Omiecinski, 2003; Rajagopal, 2002; Warme and Lundy, 1988), or based on a very

small sample (Acker and Haque, 2017). One recent study has drawn on data from 10,000 PhD graduates; however, the analyses for this research are limited to statistical profiles and are based on data collected from a single institution, the University of Toronto (see Reithmeier *et al.*, 2019). Thus, there is still need for nationally representative research to consider field of study when examining the academic/non-academic employment outcomes of doctoral degree holders (see Acker and Haque, 2017), and were unable to find any recent population-based research that distinguishes among doctoral graduates employed in temporary versus permanent academic positions.

The purpose of this research is to provide a Canadian perspective to a growing body of international research on this topic by identifying the extent to which factors, especially field of study, predict whether doctoral graduates obtain jobs commensurate with their education and expectations, using Canada as a case study. This is an especially important policy concern facing a growing segment of the Canadian workforce, where it is unknown regarding how various factors, particularly field of study choices, influence one's likelihood of being employed in temporary versus permanent academic positions, or in jobs outside the academic profession.

Methods

To examine these issues, we draw on data from Statistics Canada's 2013 National Graduates Survey (NGS). The NGS represents the largest survey available in Canada to analyze the education-to-work transitions of postsecondary graduates of a single cohort. The survey population is postsecondary graduates of Canadian public institutions (trades, community college and university) who completed the requirements of their programs and obtained their degrees, diplomas, or certificates in 2009 or 2010. The data were collected using computer-assisted telephone interviews (CATI) between April 2, 2013 and September 1, 2013, approximately 4 years after graduation for 2009 graduates, and 3 years after graduation for those who graduated in 2010.

The format for the 2013 NGS is different from previous waves of National Graduate Surveys where the respondents were surveyed two and then again five years after graduation, making accurate comparisons with previous cohorts problematic. The 2013 survey employed a cross-sectional, stratified random sampling design, and all analyses are weighted to adjust for the complexity of the sampling mechanism. The total sample for the NGS consists of 28,715 respondents who completed their postsecondary program in 2009 or 2010, and the analyses for this study are restricted to NGS respondents who were employed at the time of the survey, approximately 3-to-4 years after graduation.

We removed approximately 5% of doctoral graduates who were unemployed, and another 5% of respondents who reported that they were not in the labor market, as there were not enough respondents in these groups to create a separate category. Approximately, 5% of the respondents were excluded from the analyses because they reported that they were working part-time to continue their education, or they completed the requirements for another credential (other than a postdoctoral fellowship) since obtaining their doctorate. By subsequently completing another credential, they would belong to another cohort of graduates. Following these exclusions, the sample size for this study is 1896 respondents. The statistical analyses for this study were performed at one of Statistics Canada's Research Data Centres.

Variables and analysis

Respondents who reported that their main job last week was a professor are classified as full-time professors, if they report working full-time (30 or more hours per week) and are employed on a full-year basis in a job lasting more than 1 year. Temporary academics (sessional instructors) include respondents who reported that their main job last week was a professor or lecturer, but typically did not work full-time on a full-year basis in a job that lasts longer than 1 year. Respondents in this category may or may not receive health or retirement benefits, and they may or may not work full-time hours (30 h a week or more); however, they are considered to be temporary academics because their employment did not last longer than 1 year in length. The exception is respondents who were postdoctoral fellows at the time of the survey. We included them in this category, because postdoctoral fellows are typically temporary academic positions in transition to becoming a full-time professor. Doctoral graduates employed as postdoctoral fellows three-years after graduation may be stuck or 'trapped' in these positions, rather than using them to acquire additional training. Thus, for the first set of regression models we created a dependent variable with three categories: (1) Employed as a full-time professor; (2) Employed as a sessional instructor or postdoctoral fellow; (3) Employed elsewhere.

While many students pursue a doctorate may become a university professor, many others may become researchers. Thus, as a supplementary analysis we estimate a second regression model using a revised employment status variable, where we broadened the first two categories of the dependent variable to include researchers. The full-time professor or researcher category includes respondents who reported that their main job last week was a university professor or a researcher in any capacity (i.e., government, business, etc.), as long as they also reported working full-time, full-year. To construct this variable, we used the National Occupation Classification (NOC) codes to identify respondents employed in research-oriented jobs, which include respondents who indicated they were employed as researchers, in research-related positions, or as research associates.

Respondents who reported that their main job last week was a professor/lecturer or a researcher in any capacity (including research assistant) but did not have an employment contract lasting longer than 1 year, were grouped in the instructor or researcher category. As was done above, this category also includes respondents who were employed as postdoctoral fellows at the time of the survey. The third and final category includes all other employed respondents. Thus, the response variable for the second analysis consists of the following three categories: (1) Employed as a full-time professor or researcher; (2) Employed as a postdoctoral fellow, or as a lecturer or researcher (but not in a full-time and full-year position lasting longer than 1 year); and (3) Employed in any other non-academic or non-research-related job.

Our analytical approach includes both descriptive statistics and regression analyses. A multiple regression framework is used when the dependent variable is influenced by several independent (explanatory) variables. Since the dependent variable consists of three discrete categories, we use multinomial logistic regression which is the appropriate method to use when the dependent variable in question is nominal (categorical) with more than two categories that cannot be ordered in any meaningful way (see Long and Freese, 2014). The independent variables include standard personal characteristics that are commonly used in the existing research examining the employment outcomes of postsecondary graduates, such as gender, marital status, whether the respondent has children, age at interview, and region of residence.

We also include measures for immigrant status, visible minority status, bilingual status (speaking English and French), and parental education, along with variables that assess whether the respondents subsidized their postsecondary education by way of government and/or non-government student loans. In addition to parental education, the government student loan variable also represents a proxy for socioeconomic status. Including variables relating to background characteristics, especially those capturing dimensions of disadvantage, on the right-hand-side of the equation is a standard approach when examining the education–work transitions literature (see Boudarbat and Connolly, 2013).

The key education-related variable in this paper is field of study. The original field of study variable in the NGS consists of 12 categories and is based on Statistics Canada's Classification of Instruction (CIP). However, due to the smaller sample size of doctoral graduates, we had to collapse several of the field of study categories together to create a variable with the following seven aggregated fields: (1) education; (2) visual and performing arts and humanities; (3) social sciences; (4) physical, natural and life sciences; (5) mathematics, computer sciences, and engineering; (6) health and fitness; and (7) business, economics, finance, and other.[5]

In our regression analyses, we also control for whether the respondents received teaching assistantships, research assistantships, and scholarships. The teaching and/

or research assistant variables capture different skillsets and experiences that would be marketable in the academic job market following graduation. Likewise, teaching assistantships are more common in some programs, whereas research assistantships are more common in others.

The respondents who reported receiving scholarships for their doctoral program were also asked whether their scholarship was sponsored by provincial source, and/or a major Tri-Council agency [i.e., Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council (NSERC), Social Sciences and Humanities Research Council (SSHRC)]. These awards are very prestigious in Canada and usually awarded to the most competitive doctoral students in their respective fields. These funding variables allow us to assess the impact that receiving significant financial assistance has on subsequent employment following graduation, while the scholarship variables, in part, also capture academic ability and promise.

We also include several measures to account for program disruptions, and the timely completion of doctoral studies. By subtracting the respondents' program start date from the date they completed their programs, we were able to create a variable that captures time-to-degree (TTD). Time-to-degree has been shown to vary greatly across fields of study, with programs such as biology, mathematics, the physical sciences and engineering exhibiting comparatively shorter completion times on average than counterparts in the social sciences and humanities (e.g., Baird, 1990). At the same time, shorter completion times have also been used as a marker of the quality of a PhD (e.g., Recotillet, 2007). We were also able to include a variable that identifies whether the respondents took a leave of absence during their doctoral program, and another variable that distinguishes between doctoral graduates who completed their programs full-time or part-time. For sample size reasons, graduates who completed their programs via some combination of full-time and part-time status were included in the part-time category. Attending a doctorate part-time, or taking a leave of absence, may be indicative of a juggling or balancing act of various roles that some graduates may face more than others (e.g., working, family responsibilities). Doctoral graduates who delayed finishing or attended their programs part-time may be characteristically different than those who completed their degrees full-time or without interruption. Thus, we included these measures to account for these differences in our models.

The primary reason why we employ a regression framework is to ensure that the differences we identify among graduates of various fields of study are not attributable to other factors that doctoral graduates may have experienced prior to, or during, their programs. The 'education-related' variables are included in our models, because they capture student experiences that occur during the process of acquiring a doctoral degree and we wanted to remove their effects from the equation. In other words, we wanted to remove their effects from the effect of field

of study, which relates more specifically to the acquisition of a particular body of knowledge and information.

We also included a question in the NGS that identifies whether the respondents held a postdoctoral fellow *prior* to their job at the time of the survey as an independent variable.[6] We included this as a control variable on the assumption that postdoctoral fellowships are helpful in securing full-time employment as a professor as some departments have stronger expectations that doctoral graduates also complete some postdoctoral education before applying for permanent faculty positions than do others.[7]

Finally, we created a variable to distinguish between respondents who reported that they pursued a PhD to become a university professor from those who did not pursue a PhD with the intention of becoming a university professor. We anticipate that students who pursue a PhD to become a professor will be more likely to become professors.[8] This variable will also provide insight into the extent to which doctoral graduates are achieving their aspirations and may predict whether doctoral graduates are employed in temporary forms of academic employment, 3-to-4 years after graduation.

Results

The descriptive statistics for the variables used in this study are provided in Table 1. In the interest of space, only the summary statistics from the table relating to the dependent variables are discussed below. Most interestingly, only 12% of doctoral graduates are employed as full-time professors 3-to-4 years after graduation, whereas more than 27% are employed as sessional instructors or postdoctoral fellows. Thus, the majority (more than 60%) of doctoral graduates are not employed as professors, either on a full-time or temporary basis. When considering both professors and researchers, just over 18% of doctoral graduates are employed in permanent (more than 1 year) full-time positions and just over 30% are employed in temporary teaching or research-related positions. Thus, just over half (51%) of the doctoral graduates in this study are not employed as professors or researchers.

A cross-tabulation of the two key independent variables, field of study and the variable that captures whether the survey respondents pursued a PhD to become a university professor, is provided in Table 2. The Chi-squared test reveals that the relationship between these two variables is statistically significant ($p < .001$). Of the seven aggregated fields of study, graduates of the fine arts and humanities are most likely to have pursued their PhD to become a university professor (82%). Likewise, graduates with PhD's in fields relating to business, economics, finance and 'other' are also very likely to have pursued their degrees to become a university professor (72%), as are respondents of science fields (59%), followed very closely

Table 1 Descriptive statistics for the variables from the 2013 National Graduates Survey (n = 1896)

	Percentage
Employment status (professor)	
Full-time professor	12.1
Sessional instructor/postdoctoral fellow	27.2
Other	60.7
Employment status (professor or researcher)	
Permanent full-time	18.4
Non-permanent	30.2
Non-academic	51.4
Sex	
Male	50.3
Female	49.7
Language	
Not bilingual	57.0
Bilingual (English and French)	43.0
Region	
Atlantic	4.8
Quebec	35.0
Ontario	29.8
West	23.5
Outside Canada	6.9
Parent has a degree	
Parent does not have university education	39.9
Parent has university education	60.1
Immigrant status	
Immigrant	34.9
Non-immigrant	65.1
Visible minority status	
Visible minority	28.5
Non-visible-minority	71.5
Respondent has dependent children	
Has dependent children	50.1
No dependent children	49.9
Marital status	
Married	78.3
Not married	21.7
	Percentage/mean
Borrowed government loans	
No government loans	65.2
Had government loans	34.8
Other loans	
No other loans	74.1
Borrowed from other sources	25.9
Leave of absence	
Took a leave of absence	14.2
Did not take a leave of absence	85.8

Table 1 *continued*

	Percentage/mean
Student status	
Full-time student	90.3
Part-time student	9.7
Field of study	
Education	6.1
Fine arts and humanities	9.7
Social sciences	19.7
Sciences	24.1
Engineering and computer sciences	22.3
Health	11.2
Business, economics, and other	6.9
Teaching assistant	
Was not a teaching assistant	40.5
Was a teaching assistant	59.5
Research assistant	
Was not a research assistant	49.2
Was a research assistant	50.8
Fellowship	
Did not receive any fellowships	26.7
Received fellowship	24.7
Provincial fellowship	12.2
Tri-council fellowship	25.6
Received both prov and tri	10.8
Had postdoctoral fellowship	
Had a postdoc prior to current job	19.3
Did not have a postdoc prior to current job	80.7
Age at interview	37.7
Time-to-degree	5.5

by social science and math, computer science, and engineering graduates (57%). Graduates of health and related fields are least likely to have pursued their degrees to become a university professor (37%).

The multinomial logistic regression estimates predicting whether respondents are employed as a university professor are provided in Table 3. The estimates in the first column are odds-ratios of being employed as a full-time professor relative to the baseline category of the response variable, which represents doctoral graduates who were not employed as professors.

Likewise, the estimates in the 'Sessional/Post Doc' column represent the odds of being a temporary instructor or postdoctoral fellow, relative to being employed in any job other than a professor or fellow, 3 years after graduation. The asterisks next to each statistic represent the level of statistical significance for each parameter estimate, while the asterisks in the last column of Table 3 represent the level of

Table 2 Graduates pursued PhD to become a university professor by field of study

Field of study	*Pursued PhD to become university professor*		
	Yes	*No*	***
	Percentage		
Education	56.1	43.9	
Arts/humanities	82.3	17.7	
Social sciences	57.0	43.0	
Sciences	58.7	41.3	
Math/computer science/engineering	56.4	43.6	
Health	36.8	63.2	
Business, economics, and other	71.7	28.3	

Source: Statistics Canada's 2013 National Graduates Survey.
***$p < .001$.

statistical significance for each variable, across all categories of the response variable. We used Wald Chi-squared tests to test for multiple parameters (e.g., categorical variables with more than two categories) at one time, and dummy (indicator) coding is used for categorical variables.

The effects of the control variables are provided in Table 3, but are not discussed due to space considerations.[9] Instead, we devote our attention to the effects of field of study and the variable that captures whether the respondents pursued their degrees to become university professors, both of which are highly statistically significant ($p < .001$). Since they are the focal variables of our study, the estimates for these variables are converted into predicted probabilities and plotted in the effect displays in Figure 1 (Pursued PhD to be University Professor) and Figure 2 (Field of Study). Effect displays are valuable for converting output from complex models into meaningful quantities so that readers who are not proficient in quantitative methods and statistics can visualize the differences between the estimates across categories of the explanatory variables (see Fox and Andersen, 2006). The estimates and corresponding 95% confidence intervals are obtained by controlling for categorical variables at their proportions, and quantitative variables at their means. To create parsimonious displays, the fitted probabilities for those employed in full-time jobs outside of academia are excluded from the figures.

The estimates in Figure 1 reveal that just under one fifth (.18) of doctoral graduates who reported that they pursued their PhD to become a university professor report being full-time professors, when controlling for the other variables in the model.[10] In comparison, doctoral graduates who did not pursue their PhD to be a professor are very unlikely to be employed as full-time professors (.03). Likewise, approximately one in three (.33) of doctoral graduates who pursued their degrees to become university professors are employed as temporary academics, in

Table 3 Multinomial logistic regression predicting whether graduates are employed as full-time or temporary professors

	Full-time professor		*Temp prof/post doc*		*Wald*
	Odds	*SE*	*Odds*	*SE*	
Female	0.898	(0.161)	0.949	(0.117)	
Age	0.992	(0.014)	0.985	(0.010)	
Not bilingual	0.678	(0.138)	0.905	(0.140)	
Region					***
Atlantic	2.489	(0.831)**	1.378	(0.405)	
Quebec	1.036	(0.258)	0.816	(0.148)	
West	1.350	(0.310)	1.081	(0.176)	
Outside Canada	2.128	(0.773)*	3.148	(0.749)***	
Ontario	–	–	–	–	
Not married	1.160	(0.274)	1.357	(0.208)*	
Has dependent children	1.154	(0.215)	1.055	(0.141)	
Immigrant	0.730	(0.171)	0.957	(0.157)	
Non-visible-minority	2.138	(0.565)**	0.874	(0.146)	**
Parent doesn't have degree	0.738	(0.126)	0.958	(0.118)	
Had government loans	0.539	(0.106)**	0.796	(0.108)	**
Borrowed from other sources	0.554	(0.120)**	0.514	(0.076)***	***
Field of study					***
Education	1.048	(0.418)	1.639	(0.546)	
Arts/humanities	0.855	(0.255)	2.288	(0.611)**	
Sciences	0.353	(0.104)***	2.231	(0.481)***	
Math/computer science/engineering	0.510	(0.141)*	0.766	(0.182)	
Health	1.315	(0.392)	2.338	(0.557)***	
Business, economics, and other	2.636	(0.815)**	2.336	(0.674)**	
Social sciences	–	–	–	–	
Took a leave of absence	0.707	(0.184)	0.855	(0.165)	
Part-time student	0.858	(0.254)	0.804	(0.180)	
Was a teaching assistant	1.018	(0.216)	0.845	(0.120)	
Was a research assistant	2.118	(0.422)***	0.873	(0.120)	***
Received Fellowship	2.726	(0.790)***	0.856	(0.145)	**
Provincial fellowship	2.740	(0.917)**	1.114	(0.229)	
Tri-council fellowship	2.465	(0.715)**	0.726	(0.129)	
Received both prov and tri fellow	2.330	(0.797)*	0.722	(0.166)	
Time-to-degree	0.975	(0.053)	0.948	(0.037)	
Had a postdoc	1.219	(0.280)	1.974	(0.285)***	***
PhD to become a professor	12.789	(3.292)***	2.946	(0.377)***	***
Observations	1896				

Source: Statistics Canada's 2013 National Graduates Survey (n = 1896).
Standard errors in parentheses.
*$p < 0.05$; **$p < .01$; ***$p < .001$.

comparison to one in five (.20) doctoral graduates who did not pursue their degrees to become university professors.

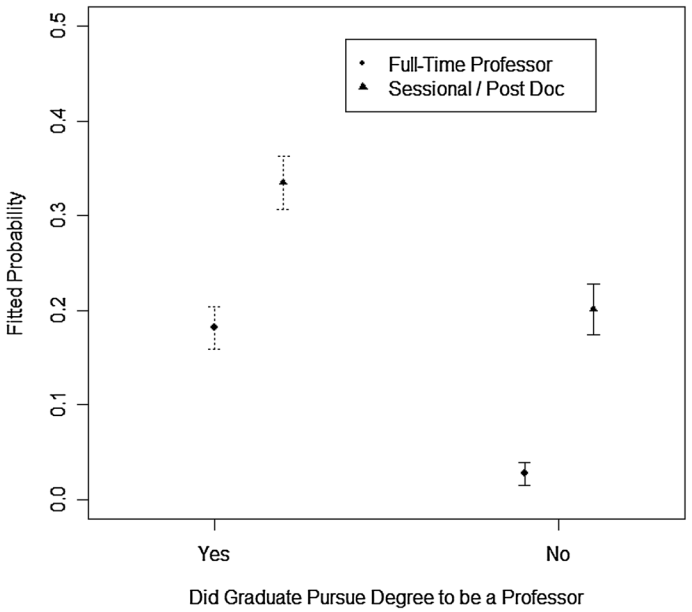

Figure 1. Pursued a Ph.D. to become a professor.

The effect display in Figure 2 provides the predicted probability of being employed as either a full-time professor or sessional instructor/postdoctoral fellow, separately by field of study. The most interesting finding in this display is that doctoral graduates of science programs are most likely to be employed as sessional instructors or postdoctoral fellows (.35) and least likely to be employed as full-time professors (.05). Doctoral graduates of the fine arts and humanities programs also have a relatively high predicted probability of being employed as a sessional instructor or fellow (.33) and comparatively low predicted probability of being employed as a full-time professor (.11). The estimates for this group of graduates are particularly noteworthy since the vast majority (82%) of fine arts and humanities graduates pursued their doctoral degrees with the intention of becoming university professors (see Table 2). The estimates and corresponding confidence intervals in Figure 2 reveal that doctoral graduates of sciences, arts and humanities, and health-related programs are statistically significantly more likely to be employed as sessional instructors or postdoctoral fellows than they are to be employed in a permanent academic position.

We also estimated a second multinomial logistic regression model predicting whether the respondents are employed as professors or researchers, either full-time, or in a temporary capacity. Since the key estimates from this model are similar to

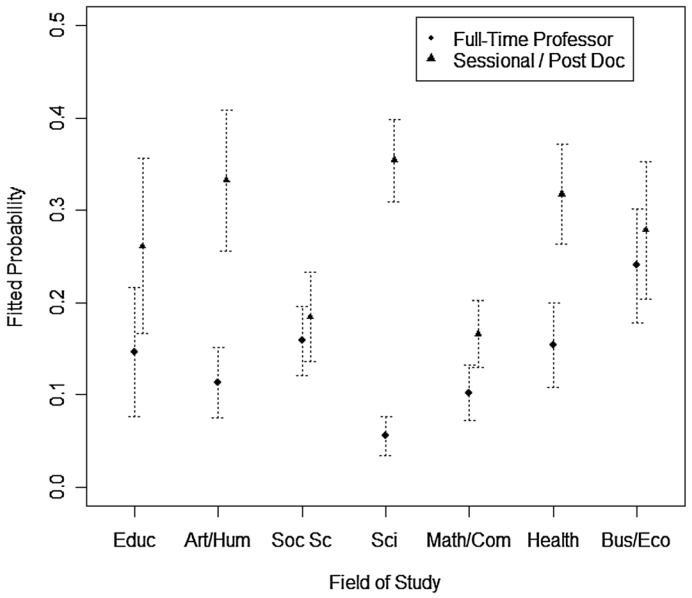

Figure 2. Academic employment by field of study.

those obtained in the above analysis, they are provided in "Appendix."[11] Similar to our analyses of the estimates in Table 3, the estimates obtained from the second multinomial logistic regression model for the field of study variable are converted to predicted probabilities and plotted in Figure 3.

The pattern displayed in Figure 3 is very similar to the pattern in Figure 2. The non-overlapping confidence intervals in Figure 3 reveal that doctoral graduates of fine arts and humanities, science, technical fields relating to math, engineering, and computer sciences, and health-related fields are statistically significantly more likely to be employed as sessional instructors, postdoctoral fellows, or in other temporary research-related jobs, than they are to be employed as full-time professors or researchers.

Discussion and Conclusions

Overall, our findings reveal that most students in Canada continue to enter their doctoral programs with their sights set on becoming university professors; however, doctoral graduates of most fields of study are significantly more likely to be working in temporary teaching and/or research-related positions than they are to be employed as permanent full-time academics, 3-to-4 years after graduation.

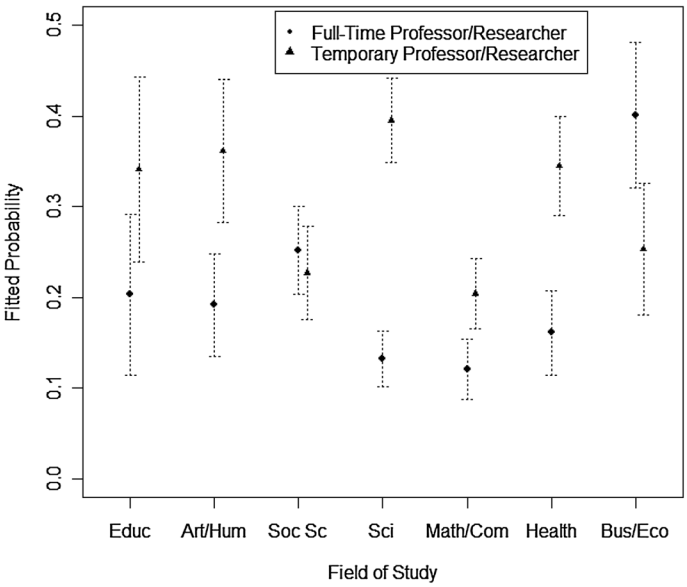

Figure 3. Employed as professor or researcher by field of study.

These findings are consistent with research in both Canada (Brownlee, 2015) and the USA which shows that non-permanent academic positions outnumber tenure-track faculty across all nonprofit institutions (see Kezar *et al.*, 2016).

The effects relating to field of study highlight the need for greater attention to the labor market experiences of graduates of traditional academic programs, such as the fine arts, humanities, and sciences. Graduates of these fields are among the *most* likely to pursue their doctoral degrees to become professors, but among the *least* likely to be employed as full-time professors and most likely to find themselves in temporary teaching and/or research-related positions. Moreover, the employment prospects facing doctoral graduates of traditional academic fields may be even more concerning than the results of this study suggest, as others argue that doctoral students who spend most of the time in their programs training to become a university professor also experience the greatest difficulties navigating non-academic labor markets (see Edge and Munro, 2015). As suggested earlier, students in this situation may also be less likely to recognize the value of their skills outside academia. Hence, they may be more likely to stick-it-out in temporary jobs hopeful to transition to a permanent position. In turn, they may also be most susceptible to potential mental health consequences, including feelings of 'failure,' associated with being unable to eventually secure a permanent full-time academic position (see Acker and Haque, 2017).

The results of this study provide good evidence that doctoral programs can benefit by placing more emphasis on providing their graduates with skills that are recognized outside of traditional academic areas, as this is where most graduates will likely find themselves after graduation. The extent to which traditional doctoral programs in Canada are adequately preparing their graduates for the labor market realities after graduation, and whether guidance/career based activates are underutilized or need to be further integrated into the PhD curriculum is unknown in Canada (see Acker and Haque, 2017). However, the situation in Canada is not unique, as research in other countries has acknowledged the importance of broadening traditional PhD training to include more than academic skills to better prepare graduates for employment in a variety settings (see Boulos, 2016; Paolo and Mañé, 2016; Jackson and Michaelson, 2015; Huisman *et al.*, 2002). To this point, our findings may also lend support for further discussion in Canada on potentially expanding the number applied and professional doctorate programs to help prepare doctoral graduates in traditional fields for employment opportunities outside of academic job markets (see Allen *et al.*, 2002). Such programs have become increasingly popular in other countries (see Wildy *et al.*, 2015; Kot and Hendel, 2011).

Some data limitations in this study are worth addressing. For example, while we included variety of variables to represent proxies for academic achievement and future academic potential, questions that would allow us to directly capture the strength of the respondents' research and publication records were not available in the NGS or linked Survey of Earned Doctorates.

Likewise, the response options to the occupation questions in the NGS also did not allow us to determine if the respondents who reported that they were professors, were employed in tenured, tenure-track, or contractually limited positions. Thus, the percentage of doctoral graduates employed as full-time tenure-track university professors 3-to-4 years after graduation is likely to be lower than the estimates in our analyses. On the other hand, while we believe that this should be a sufficient amount of time for doctoral graduates to acquire a job related to their training, it may take longer for some doctoral graduates to settle into a permanent full-time academic position. Unfortunately, since Statistics Canada no longer administers the five-year follow-up to the NGS, we were unable to make this assessment.

The above data limitations notwithstanding, it is important to emphasize that more than a quarter of PhD graduates are still navigating non-permanent forms of employment in academic job markets, 3-to-4 years after graduation. Thus, considering that the typical respondent in our sample is just under 38 years of age at the time of the survey, current and future doctoral students should also be aware that significant minority of them may still be trying to launch their careers at a relatively late stage in life. Moreover, if doctoral graduates anticipate that it takes an exceptional amount of time after graduation to secure permanent employment as

a professor, this may exasperate the problem by encouraging doctoral graduates to navigate temporary academic employment even longer.

In sum, the results of this study provide very timely and relevant information to future students, policy makers and institutional officials responsible for overseeing the supply and demand of doctoral graduates of various fields, as well as researchers and policy analysts in other countries. Since most doctoral graduates in Canada will not be employed as full-time professors, graduate program coordinators might consider providing their students with education and training that accommodates the reality facing doctoral graduates making their education-to-work transitions. In addition to preparing doctoral students for employment outside of traditional academic areas, doctoral programs may also encourage doctoral students to recognize the transferability of their skills (e.g., writing, research, critical thinking) across sectors, and play an active role in promoting the value of these skills to future employers. This will also help to improve the receptor capacity for doctoral graduates, particularly those with degrees in the arts and sciences. Finally, future research should aim to provide a better understanding of which doctoral programs are most successful in helping their graduates navigate labor markets outside academia.

Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Notes

1 A doctoral degree is the highest level academic degree, and it is generally required to be a full-time professor at degree-granting level institutions (universities in Canada). While there are several forms of doctoral degrees (including honourary doctorates), the Doctor of Philosophy (PhD) is by far the most common type. So much so, that the terms doctorate, doctoral degree, and PhD are typically used synonymously in the literature. Our research is based on analyses of earned doctorates, where doctoral graduates of professional degree programs (e.g., Medical Doctor, Doctor of Jurisprudence, and Doctor of Pharmacy) are excluded. Thus, we will use the terms doctorate, earned doctorate, or doctoral degree interchangeably when reporting our findings. However, when referencing past research, we will adopt the terminology (e.g., PhD) used in the source document.

2 It should be noted that the anticipated retirements, or lack thereof, have not significantly changed the academic career prospects for younger cohorts of doctoral graduates in Canada (Edge and Munro, 2015, 20).

3 The word ‘professor’ in Canada, as in the USA, is often used as a blanket term to refer to full, associate, and assistant professors, and sometimes lecturers or instructors. Internationally, however, the term professor typically refers to full professors.

4 It is important to note that Desjardins and King's (2011) research does not differentiate between academic and non-academic work.
5 Due to issues relating to sample size, this category also includes graduates of multidisciplinary fields and newer fields of study that do not fit in the traditional aggregated field of study categories. A significant percentage of graduates of interdisciplinary fields received degrees that were cross-listed in business, economics, finance, and similar fields of study. Moreover, preliminary analyses revealed that their academic job outcomes are very similar to those of graduates with doctoral degrees in economics, finance, and business administration.
6 A small number of respondents were removed from the analyses if the postdoctoral fellowship they held prior to their current job was the same postdoctoral fellowship they held at the time of the survey.
7 We estimated models with and without the postdoctoral fellow variable. Since the effect of field of study did not change markedly when the postdoctoral fellowship variable was included in the model, we only presented the estimates for the model that include the postdoctoral variable in Table 3.
8 The exact question in the NGS is 'What are the reasons for your pursuit of a Ph.D.? Is it because you want to…?' where nearly 60% of the respondents answered: 'Become a university professor.'
9 We would like to emphasize that the non-statistically significant effect of gender is likely attributable to recent hiring and employment decisions by universities which, as with other government organizations in Canada, are heavily protected by strong labor standards, in many cases through collective bargaining agreements, to promote inclusive labor markets (see Konstantopoulos and Constant, 2008). Other recent research, also drawing on NGS data, has found that men and women with earned doctorates in Canada report very similar labor market outcomes (see Ferguson and Wang, 2014; Jehn *et al.*, 2019).
10 When not otherwise stated, all results are to be interpreted as controlling for the other variables in the model.
11 Since the response variable captures both professors and researchers, we did not include whether the respondents pursued their PhD to become a university professor in this model.

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Appendix

See Table 4.

Table 4 Multinomial logistic regression predicting whether respondents are employed as full-time professors/researchers, or temporary professors/researchers.
Source: 2013 National Graduates Survey (n = 1896)

	Full-time professor		*Temp prof/researcher*		*Wald*
	Odds	*SE*	*Odds*	*SE*	
Female	0.867	(0.126)	0.883	(0.106)	
Age	1.001	(0.011)	0.993	(0.010)	
Not bilingual	0.615	(0.104)***	0.953	(0.144)	*
Region					***
Atlantic	2.195	(0.654)**	1.87	(0.545)*	
Quebec	0.821	(0.166)	0.904	(0.160)	
West	0.797	(0.151)	1.005	(0.157)	
Outside Canada	1.465	(0.484)	3.785	(0.918)***	
Ontario	–	–	–	–	
Not married	0.93	(0.178)	1.327	(0.198)	
Has dependent children	1.158	(0.175)	1.205	(0.156)	
Immigrant	0.849	(0.163)	1.093	(0.173)	
Non-visible-minority	1.428	(0.292)	1.033	(0.168)	
Parent does not have degree	0.629	(0.088)***	0.944	(0.113)	**
Had government loans	0.736	(0.115)*	0.695	(0.093)**	*
Borrowed from other sources	0.662	(0.112)*	0.446	(0.065)***	***
Field of study					***
Education	0.916	(0.321)	1.797	(0.558)	
Arts/humanities	0.882	(0.228)	1.955	(0.508)**	
Sciences	0.556	(0.123)**	2.025	(0.417)***	
Math/computer science/engineering	0.338	(0.080)***	0.666	(0.148)	
Health	0.652	(0.164)	1.663	(0.374)*	
Business, economics, and other	2.672	(0.718)***	1.766	(0.519)	
Social sciences	–	–	–	–	
Took a leave of absence	0.647	(0.139)*	0.892	(0.161)	
Part-time student	0.929	(0.217)	0.664	(0.144)	
Was a teaching assistant	1.124	(0.192)	0.934	(0.129)	
Was a research assistant	1.701	(0.274)***	0.962	(0.129)	**
Received fellowship	2.78	(0.638)***	0.957	(0.157)	***
Provincial fellowship	2.787	(0.746)***	1.214	(0.244)	
Tri-council fellowship	3.343	(0.770)***	0.952	(0.161)	
Received both prov and tri fellow	3.516	(0.963)***	0.876	(0.196)	
Time-to-degree	0.99	(0.042)	0.956	(0.035)	
Had a postdoc	1.222	(0.228)	1.721	(0.248)**	***
Observations	1896				

Standard errors in parentheses
*$p < 0.05$; **$p < .01$; ***$p < .001$